

FORM PTO-1390 (Modified)
(REV 11-2000)

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

ATTORNEY'S DOCKET NUMBER

**TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. 371**

Y-190

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR

10/030448

INTERNATIONAL APPLICATION NO.

PCT/JP00/06884

INTERNATIONAL FILING DATE

3 October 2000

PRIORITY DATE CLAIMED

4 October 1999

TITLE OF INVENTION

LOUDSPEAKER

APPLICANT(S) FOR DO/EO/US

Shinya MIZONE et al

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (24) indicated below.
4. ☐ The US has been elected by the expiration of 19 months from the priority date (Article 31).
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c) (2))
 - a. ☐ is attached hereto (required only if not communicated by the International Bureau).
 - b. ☒ has been communicated by the International Bureau.
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
 - a. ☒ is attached hereto.
 - b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
 - a. ☐ are attached hereto (required only if not communicated by the International Bureau).
 - b. ☐ have been communicated by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☒ have not been made and will not be made.
8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
10. ☐ An English language translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).
11. ☐ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☒ A copy of the International Search Report (PCT/ISA/210).

Items 13 to 20 below concern document(s) or information included:

13. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☒ A **FIRST** preliminary amendment.
16. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
17. ☐ A substitute specification.
18. ☐ A change of power of attorney and/or address letter.
19. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.
20. ☒ A second copy of the published international application under 35 U.S.C. 154(d)(4).
21. ☒ A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
22. ☒ Certificate of Mailing by Express Mail
23. ☒ Other items or information:

Inventor Information Sheet (Patent Bibliographical Data)**Form PTO-1449 and copies of documents listed thereon with second copy of Int. Search Report****Petition for revival of an International application for patent designating the US abandoned unintentionally***Express Mail #EL898005514 US*

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR 1.01) 10/030448	INTERNATIONAL APPLICATION NO. PCT/JP00/06884	ATTORNEY'S DOCKET NUMBER Y-190
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24. The following fees are submitted:				CALCULATIONS PTO USE ONLY	
BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :					
<input type="checkbox"/> Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO \$1040.00					
<input checked="" type="checkbox"/> International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO \$890.00					
<input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO \$740.00					
<input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) \$710.00					
<input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) \$100.00					
ENTER APPROPRIATE BASIC FEE AMOUNT =				\$890.00	
Surcharge of \$130.00 for furnishing the oath or declaration later than <input checked="" type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492 (e)).				\$130.00	
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	9 - 20 =	0	x \$18.00	\$0.00	
Independent claims	2 - 3 =	0	x \$80.00	\$0.00	
Multiple Dependent Claims (check if applicable). <input type="checkbox"/>				\$0.00	
TOTAL OF ABOVE CALCULATIONS =				\$1,020.00	
<input type="checkbox"/> Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2.				\$0.00	
SUBTOTAL =				\$1,020.00	
Processing fee of \$130.00 for furnishing the English translation later than <input checked="" type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492 (f)).				\$130.00	
TOTAL NATIONAL FEE =				\$1,150.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) (check if applicable). <input type="checkbox"/>				\$0.00	
TOTAL FEES ENCLOSED =				\$1,150.00	
				Amount to be: refunded	\$
				charged	\$

- a. ☐ A check in the amount of _____ to cover the above fees is enclosed.
- b. ☐ Please charge my Deposit Account No. _____ in the amount of _____ to cover the above fees. A duplicate copy of this sheet is enclosed.
- c. ☐ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. _____. A duplicate copy of this sheet is enclosed.
- d. ☒ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. **Credit card information should not be included on this form.** Provide credit card information and authorization on PTO-2038.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

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 SIGNATURE

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NAME

35,731

REGISTRATION NUMBER

JAN 2, 2002
 DATE

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of

Shinya MIZONE et al

Art Unit:

S. N.

Examiner:

International S.N.: PCT/JP00/06884

Filed:

International Filing Date: 3 October 2000

For: LOUDSPEAKER

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Please make the following amendments to this application
prior to examination thereof:

In the Claims:

Please amend claims 1 and 2 by replacing them with the like
numbered claims hereinbelow. A marked up set of claims is
provided at the end of this document to illustrate the changes
made for the Examiner.

1. (Amended) A speaker comprising:

a magnetic circuit having a center magnetic pole and an
air gap;

a voice coil wound around a voice coil bobbin disposed
in the air gap of the magnetic circuit;

a frame mounted onto the magnetic circuit; and

a cone-shaped diaphragm made from foamed resin with 30µm in average cell size and disposed between the frame and one end of the voice coil bobbin.

2. (Amended) A speaker of claim 1, wherein the resin making the cone-shaped diaphragm is polyethylene terephthalate.

Add new claims 3-9 as follows:

3. A speaker of claim 1, wherein the resin making the cone-shaped diaphragm is polyethylene naphthalate.

4. A speaker comprising:

a magnetic circuit having a center magnetic pole and an air gap;

a voice coil wound around a voice coil bobbin disposed in the air gap of the magnetic circuit;

a frame mounted onto the magnetic circuit;

a cone-shaped diaphragm made from foamed resin and disposed between the frame and the one end of the voice coil bobbin;

a support mounted on the center magnetic pole of the magnetic circuit including an induction coil wound around the support; and

at least one light source held in a holder secured to the end of the support for directing light onto the cone-shaped diaphragm by being energized by the voltage induced in the induction coil.

5. A speaker of claim 4, wherein the holder is configured to hold a plurality of light emitting diodes (LEDs) directed to illuminate the cone-shaped diaphragm in radial manner.

6. A speaker of claim 4, wherein the light source is controlled to emit light of different color depending on the audio signal to be applied to the voice coil.

7. A speaker of claim 5, wherein the light source is controlled to emit light of different color depending on the audio signal to be applied to the voice coil.

8. A diaphragm for speaker made from foamed thermoplastic resin with 30µm or smaller in average cell size.

9. A diaphragm for speaker of claim 8, wherein the foamed thermoplastic resin is either polyethylene terephthalate or polyethylene naphthalate.

REMARKS

The above amendments are presented to more clearly define the invention and to place the claims in better condition for examination.

Respectfully submitted,


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MARKUP SHEET SHOWING CLAIM AMENDMENTS MADE HEREIN

1. (Amended) A speaker comprising:

a magnetic circuit[,] having a center magnetic pole and
an air gap;

a voice coil wound around a voice coil bobbin disposed
in the air gap of the magnetic circuit;

a frame mounted onto the magnetic circuit[,]; and

a [voice coil disposed in a magnetic gap of the
magnetic circuit and a] cone-shaped diaphragm [having edges
adhered to a voice coil bobbin of the voice coil and the frame,
characterized in that the cone-shaped diaphragm is made
from foamed thermoplastic resin such as polyethylene
terephthalate (PET) resin or polyethylene naphthalate (PEN) resin
with 30µm or smaller average cell size] made from foamed resin
with 30µm in average cell size and disposed between the frame and
one end of the voice coil bobbin.

2. (Amended) A speaker of claim 1, [comprising a magnetic
circuit, a cylindrical support mounted on a center magnetic pole
of the magnetic circuit, an induction coil wound around a center
portion of the support with a gap from the voice coil bobbin, the
cone-shaped diaphragm having edges adhered to the voice coil
bobbin and the frame, an LED holder mounted at the end of the
support, and a plurality of LEDs held in the LED holder for
directing light onto the surface of the cone-shaped diaphragm]
wherein the resin making the cone-shaped diaphragm is polyethylene
terephthalate.

5/pst

SPEAKER

Field of Invention

The present invention relates generally to a speaker, more specifically to a speaker using light weight, highly rigid cone-shaped diaphragm to provide excellent frequency response.

Background of Invention

In conventional speakers, paper pulp, metal, polypropylene, etc. are normally used as the diaphragm.

These conventional diaphragms have various drawbacks. Those made primarily from paper pulp are not moisture-resistant, fade under normal environment and degrade in aging. Those made from metal are hard on the surfaces and have high Young's modulus of elasticity but encounter harmonic distortion due to split vibrations and poor processability such as adhesiveness. Those made of synthetic resin such as polypropylene (PP) or formed polyethylene are low density, poor rigidity and poor heat-resistant.

Disclosure of the Invention

In order to overcome these drawbacks, the speaker according to the present invention features in constructing a cone-shaped diaphragm made from thermoplastic resin such as polyethylene terephthalate resin (PET) or polyethylene naphthalate resin (PEN) with ultra micro foam of 30 micron or less in average cell size. Such cone-shaped diaphragm is light weight, provides large internal loss, is excellent in rigidity (high in acoustic speed) and provides excellent sound quality.

Brief Description of Drawings

FIG.1 is a longitudinal cross-section view of the speaker according to a first embodiment of the present invention:

FIG.2 is a microscopic photograph in cross-section of the diaphragm of the primary portion of the speaker according to the present invention;

FIG.3 shows frequency response characteristics of the speaker according to the first embodiment of the present invention using a diaphragm made from PET;

FIG.4 is a longitudinal cross-section view of the speaker according to the second embodiment of the present invention; and

FIG.5 is a characteristic curve showing the spectral reflection of the cone-shaped diaphragm to be used in the speaker of the present invention.

Preferred Embodiments of the Invention

(First Embodiment)

Now, a first embodiment of the speaker according to the present invention will be described by reference to FIGs.1 and 2.

As illustrated in FIG.1, the speaker 1 according to the present invention comprises a magnetic circuit 2 including a magnet 7 and a center magnetic pole 22 having a ring-shaped magnetic gap 21, a cover 9 for firmly holding outside the magnetic circuit 2, a voice coil 3 disposed in the ring-shaped magnetic gap 21, a damper 4 disposed between the voice coil bobbin 31 for the voice coil 3 and a frame 6 for holding the voice coil 3 in the ring-shaped magnetic gap 21 and a cone-shaped diaphragm 5 adhered to the edge of the voice coil bobbin 31 and having an outer periphery adhered to the inner periphery of the edge 51. The edge 51 is then adhered to the outer edge portion of the frame 6.

Now, the cone-shaped diaphragm 5 will be described in detail hereunder. The cone-shaped diaphragm 5 is made from foamed polyethylene terephthalate (PET) commercially available from Furukawa Electric Industries under the trademark of "MCPET" or foamed polyethylene naphthalate (PEN) .

As apparent from the microscopic photograph in cross-section of the cone-shaped diaphragm, the diaphragm made from PET in the embodiment according to the present invention has small cells. Illustrated at the bottom in FIG.2 is a scale of 11 dots having 3 micron gap between adjacent dots.

Illustrated in Table 1 below is comparison of various characteristics of the speaker utilizing the cone-shaped diaphragms according to the present invention and speakers utilizing diaphragms made from conventional materials. The speakers are 16cm in diameter.

(Table 1)

	present speaker using PET diaphragm	present speaker using PEN diaphragm	reference speaker using PP diaphragm	reference speaker using paper pulp diaphragm
density	0.25~0.35	0.33	1.15~1.20	0.7~0.8
extent of foaming	3.8~5.4	4		
thickness (mm)	0.85	0.60	0.35	0.35~0.4
average cell diameter (μ m)	20	10		
weight	2.3	2.0	4.5	2.3

	(g / mm ²)			
acoustic	1850	2050	1800	1600
speed				
	(m/s)			
tan δ	0.040	0.06	0.065	0.035
resistance	no change	no change	fade	easy to fade
to UV				

Notes

- (1) light weight and thick, less split vibrations to cause less distortion.
- (2) light weight and thick. less split vibrations to cause less distortion.
- (3) larger tan δ and less distortion but heavy and less sound pressure as a speaker.
- (4) high sound pressure as a speaker and larger distortion. Poor appearance.

In fabrication process of the cone-shaped diaphragm in Table 1, an attempt was made to make a diaphragm of PET with 500 μ m average cell diameter. However, rigidity (acoustic speed) was significantly low and characteristics as the diaphragm for speaker were inferior to those of the reference speakers in Table 1.

This leads to a conclusion that simple foaming of resin is not usable as a speaker diaphragm. Table 1 proves that a speaker using a cone-shaped diaphragm made from resin having ultra micro foaming of 30 μ m or less average cell size is lighter and high rigid to provide excellent speaker characteristics.

As apparent from the reference value in Table 1, the speaker using a conventional diaphragm made from paper pulp has smaller tan δ , larger distortion and poor appearance quality. On the other hand, the diaphragm made from PP has larger tan δ , smaller distortion, larger weight and lower reproduced sound pressure of the speaker.

Illustrated in FIG.3 are frequency characteristic curves of the speakers using a diaphragm made from PET according to the present invention. ① is the sound pressure frequency characteristic of the speaker on the center axis (0°). ② is the frequency characteristic of the second harmonic distortion. ③ is the frequency characteristic of the third harmonic distortion. ④ is the impedance characteristic of the voice coil. Although not shown in FIG.3, the speaker according to the present invention is 1.5dB higher in average in the sound pressure frequency response and exhibits less second and third harmonics as compared to the reference speaker.

It is assumed that the use of foamed resin of 30 μ m or smaller cell size is responsible for obtaining the light weight, highly rigid cone-shaped diaphragm.

Since the diaphragm according to the present invention can be used exactly the same manner as the conventional diaphragms, it is unnecessary to modify any step of making speakers. It is possible to obtain uniform quality and improve sound quality.

(Second Embodiment)

Now, the second embodiment of the speaker according to the present invention will be described by reference to FIG.4. In FIG.4, elements identical to those in the first embodiment as illustrated in FIG.1 are represented by identical reference numerals.

As illustrated in FIG.4, the speaker 1 comprises a magnetic circuit 2 having a center magnetic pole 22, a cylindrical support 8 mounted onto the base of the center magnetic pole 22, an induction coil 81 mounted on the middle portion of the support 8 with a certain gap from the voice coil bobbin 31 and an LED holder 83 disposed at the end of the support 8. The LED holder 83 is designed to radially hold a plurality of LEDs 82 so that light is emitted through respective openings onto the surface of the cone-shaped diaphragm 5.

The cone-shaped diaphragm 5 is identical to the cone-shaped diaphragm of the first embodiment and made from foamed PET with $30\mu\text{m}$ or smaller average cell size.

Illustrated in FIG.5 is a characteristic curve showing spectral reflection on the surface of the cone-shaped diaphragm used in the second embodiment. It is apparent from FIG.5 that the reflection characteristic is very good over the entire zone of visible rays.

By using the cone-shaped diaphragm made from foamed resin with $30\mu\text{m}$ or smaller average cell size, the diaphragm becomes highly rigid and thus providing an excellent speaker. Also, the use of $30\mu\text{m}$ or smaller average cell size is effective to provide the cone-shaped diaphragm of excellent reflectance, thereby enabling to provide a speaker with enhanced visual interest.

When an audio signal is applied to the voice coil of the speaker 1, the voice coil 3 vibrates in the magnetic gap 21. Such vibration is transferred to the cone-shaped diaphragm 5 to generate audio sound. At this time, the vibration of the voice coil 3 develops magnetic flux and magnetic field in the magnetic gap 21. The induction coil 82 wound around the voice coil bobbin 31 with a space intersects with the inductive magnetic field to induce an inductive current in the inductive coil 82. The induced voltage is 2~3 volts and is used (after necessary amplification) to turn on and off the LEDs 82.

In the above configuration, LEDs 82 are controlled to selectively emit different colored light such as blue, red, yellow, etc. in response to the vibration magnitude of the voice coil 3 of the speaker 1. LEDs 82 are disposed near the surface of the

diaphragm 5 in an orientation to illuminate the diaphragm 5. Since the diaphragm 5 has excellent spectral characteristic, almost all light from LEDs 82 is total reflected to illuminate a large area of the cone-shaped diaphragm 5 in response to high/low or strong/weak of the reproduced sound. This arrangement is effective to entertain the listeners visually in addition to the audio.

Industrial Applicability

As apparent from the above description, the speaker according to the present invention features in using the cone-shaped diaphragm made from thermoplastic resin such as polyethylene terephthalate (PET) resin or polyethylene naphthalate (PEN) resin with ultra micro foam of $30\text{ }\mu\text{m}$ or smaller average cell size. The diaphragm is light and yet has larger internal loss and excellent rigidity (fast acoustic speed) to provide the speaker having excellent sound quality.

Also, the speaker comprises the cylindrical support at the base of the center magnetic pole of the magnetic circuit, the induction coil wound around the support at the middle portion separating from the voice coil and a plurality of LEDs radially disposed in the LED holder secured to the end of the support. The LEDs are selectively turned on or off in response to the driving of the voice coil bobbin of the speaker. The cone-shaped diaphragm is made from formed resin of $30\text{ }\mu\text{m}$ or smaller average cell size. In this arrangement, the surface of the diaphragm has improved spectral reflectance to provide visual entertainment.

Claims

1. A speaker comprising a magnetic circuit, a frame mounted on the magnetic circuit, a voice coil disposed in a magnetic gap of the magnetic circuit and a cone-shaped diaphragm having edges adhered to a voice coil bobbin of the voice coil and the frame,

characterized in that the cone-shaped diaphragm is made from foamed thermoplastic resin such as polyethylene terephthalate (PET) resin or polyethylene naphthalate (PEN) resin with 30 μ m or smaller average cell size.

2. A speaker of claim 1 comprising a magnetic circuit, a cylindrical support mounted on a center magnetic pole of the magnetic circuit, an induction coil wound around a center portion of the support with a gap from the voice coil bobbin, the cone-shaped diaphragm having edges adhered to the voice coil bobbin and the frame, an LED holder mounted at the end of the support, and a plurality of LEDs held in the LED holder for directing light onto the surface of the cone-shaped diaphragm.

ABSTRACT

The present invention is directed to a speaker using lightweight, highly rigid diaphragm having excellent frequency characteristic and improving resistance to environment (including resistance to UV and resistance to fading) . For this end, the speaker utilizes a cone-shaped diaphragm made from foamed or cellular resin such as polyethylene terephthalate (PET) resin or polyethylene naphthalate (PEN) resin with 30 μ m average cell size. The use of such cone-shaped diaphragm is effective to improve sound quality of the speaker.

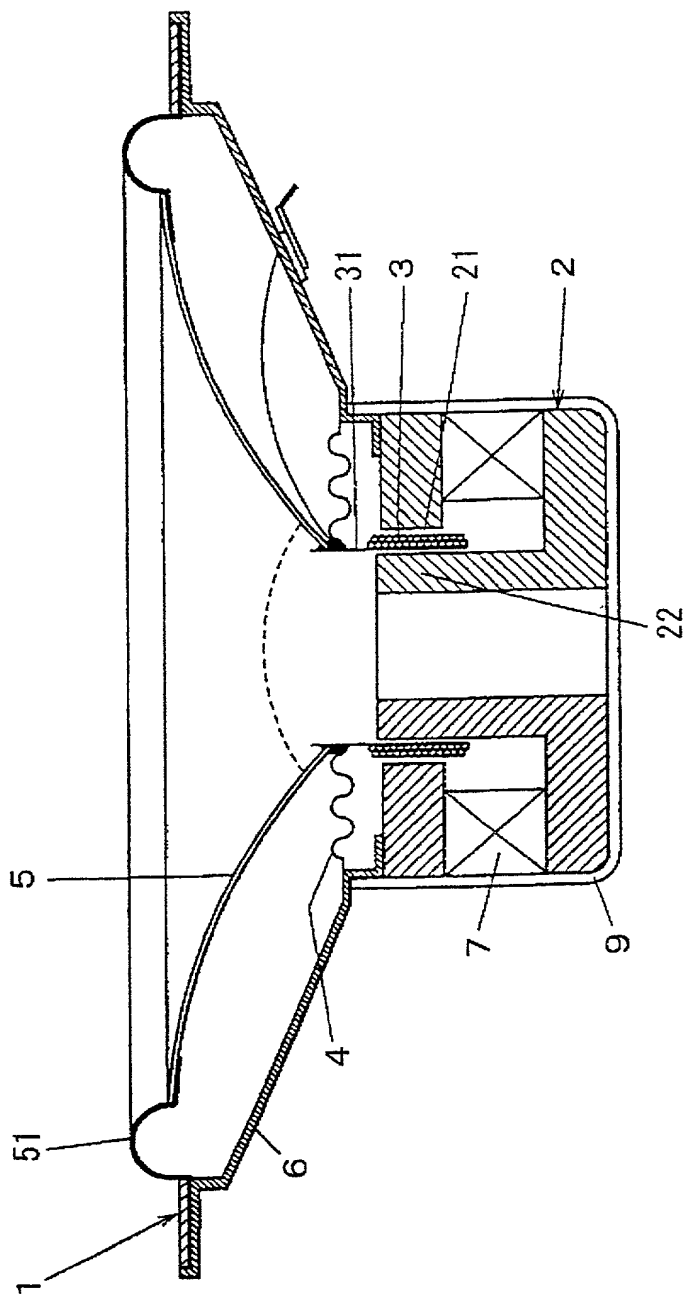


FIG. 1

FIG. 2

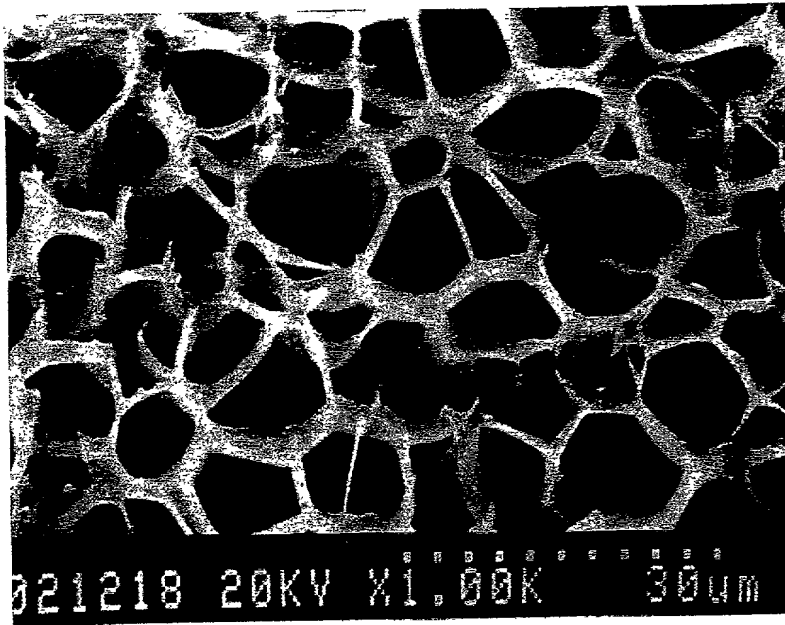
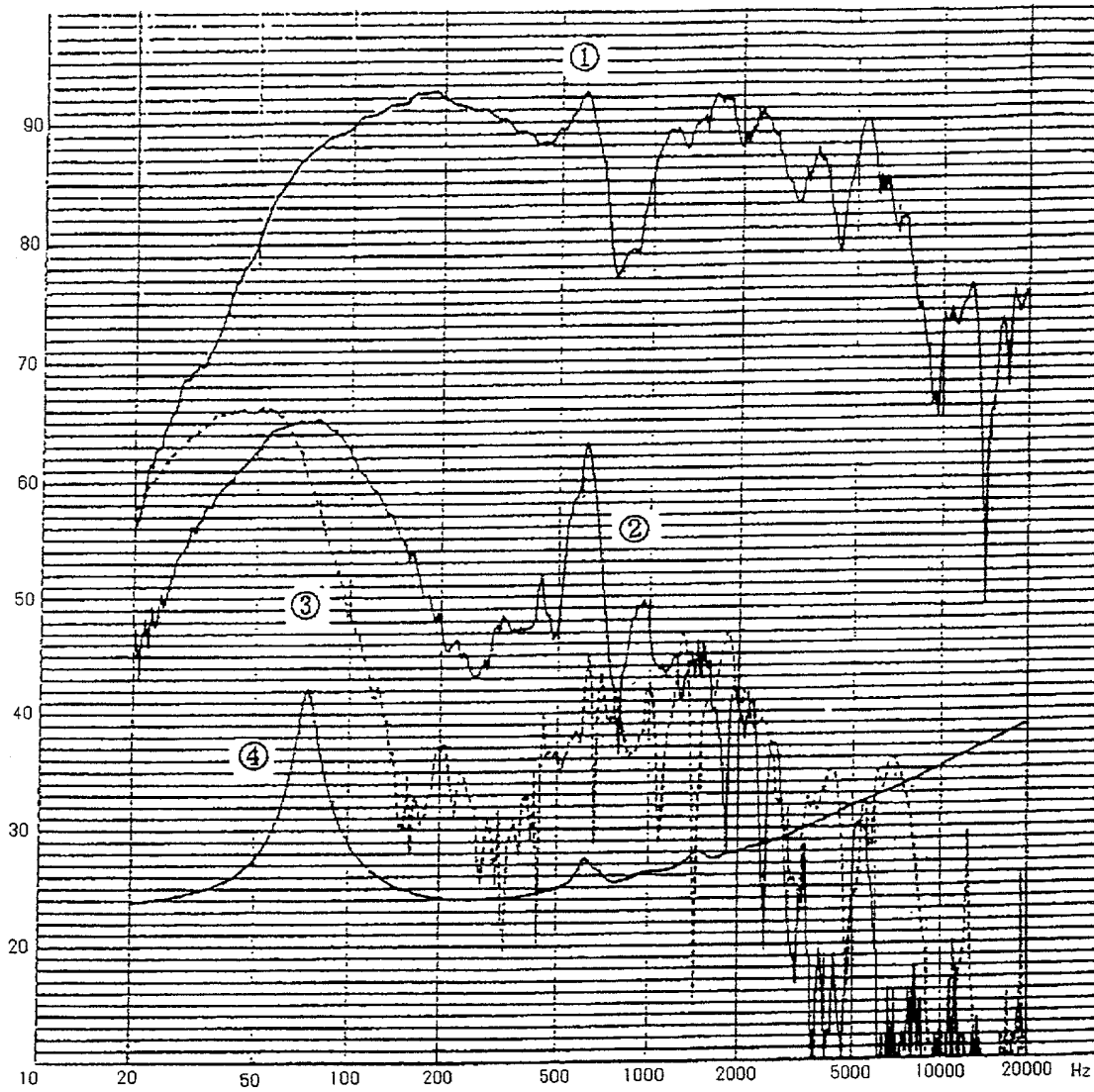


FIG. 3



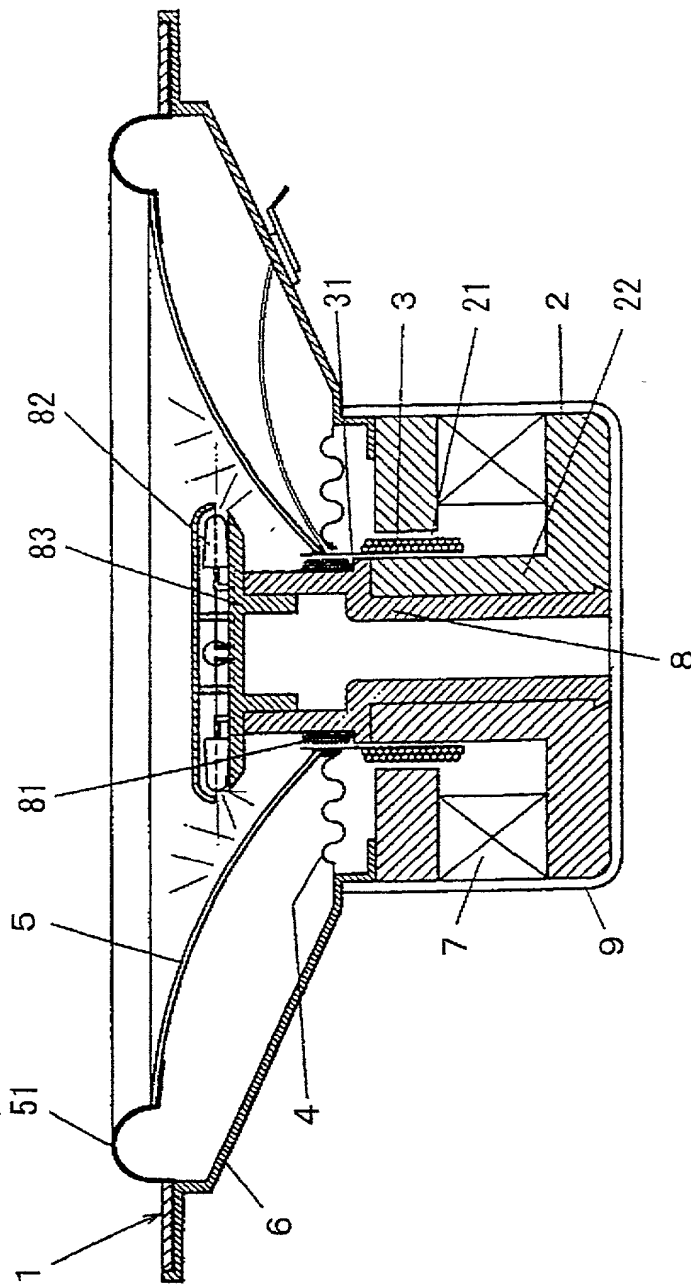
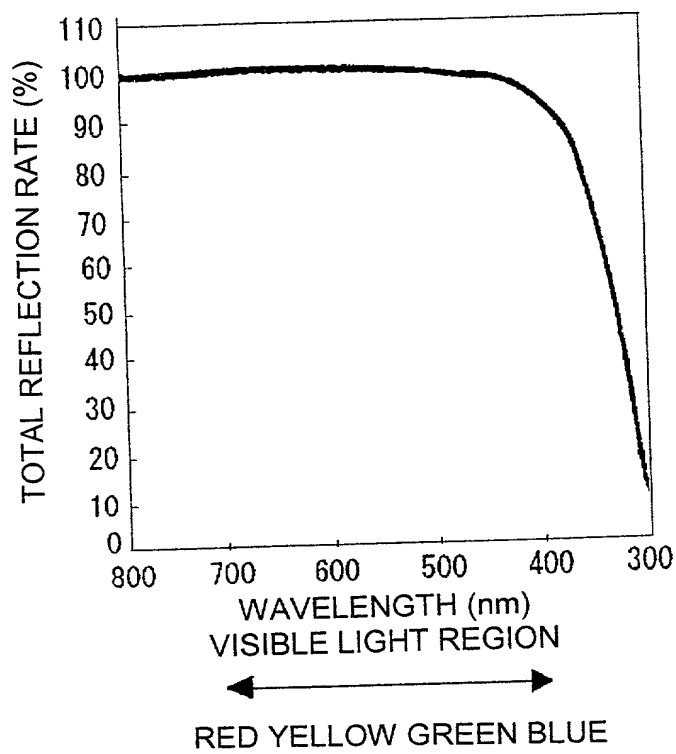


FIG. 5



Docket No.
Y-190

Declaration and Power of Attorney For Patent Application

English Language Declaration

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

LOUDSPEAKER

the specification of which

(check one)

☐ is attached hereto.

☒ was filed on October 3, 2000 as United States Application No. or PCT International

Application Number PCT/JP00/06884

and was amended on _____

(if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d) or Section 365(b) of any foreign application(s) for patent or inventor's certificate, or Section 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate or PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)			Priority Not Claimed
<u>11-283436</u>	<u>JAPAN</u>	<u>4 October 1999</u>	<input type="checkbox"/>
(Number)	(Country)	(Day/Month/Year Filed)	
_____	_____	_____	<input type="checkbox"/>
(Number)	(Country)	(Day/Month/Year Filed)	
_____	_____	_____	<input type="checkbox"/>
(Number)	(Country)	(Day/Month/Year Filed)	

I hereby claim the benefit under 35 U.S.C. Section 119(e) of any United States provisional application(s) listed below:

(Application Serial No.)

(Filing Date)

(Application Serial No.)

(Filing Date)

(Application Serial No.)

(Filing Date)

I hereby claim the benefit under 35 U. S. C. Section 120 of any United States application(s), or Section 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. Section 112, I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, C. F. R., Section 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application:

(Application Serial No.)

(Filing Date)

(Status)
(patented, pending, abandoned)

(Application Serial No.)

(Filing Date)

(Status)
(patented, pending, abandoned)

(Application Serial No.)

(Filing Date)

(Status)
(patented, pending, abandoned)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. *(list name and registration number)*

James H. Walters, Reg. No. 35,731

I authorize the attorney that I have appointed to accept instructions regarding this application and the resulting patent from Mr. Masaaki Yen.

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 James H. Walters 503-224-0115

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Sole or first inventor's signature <i>Shinya Mizone</i>	Date <i>Dec. 25. 2001</i>
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Citizenship JAPAN	
Post Office Address 1488-107, Ishidenkouzubeta	
Tsu-shi, Mie 514-0061 JAPAN	

Full name of second inventor, if any Keiji Ishikawa	
Second inventor's signature <i>Keiji Ishikawa</i>	Date <i>Dec. 25. 2001</i>
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Citizenship JAPAN	
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Full name of third inventor, if any Shoouji Nakajima	
Third inventor's signature <i>Shoouji Nakajima</i>	Date <i>Dec. 25, 2001</i>
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Citizenship JAPAN	
Post Office Address 3022-7, Nagaokacho	
Tsu-shi, Mie 514-0064 JAPAN	

Full name of fourth inventor, if any Akira Kabumoto	
Fourth inventor's signature <i>Akira Kabumoto</i>	Date <i>Dec. 25, 2001</i>
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Full name of fifth inventor, if any Satoshi Ono	
Fifth inventor's signature <i>Satoshi Ono</i>	Date <i>Dec. 25, 2001</i>
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Kawasaki-shi, Kanagawa 211-0068 JAPAN	

Full name of sixth inventor, if any	
Sixth inventor's signature	Date
Residence	
Citizenship	
Post Office Address	